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Severe tissue destruction in the ear caused by alkaline button batteries

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Summary: Button batteries spontaneously leak corrosive electrolyte solution on exposure to moisture. Tissue in contact with such solution will undergo liquefaction necrosis. Three cases of skin, bone and tympanic membrane necrosis caused by a leaking button battery lodged in the external auditory meatus are described.

Introduction

Button batteries are used to power various electronic devices such as hearing aids, watches, calculators and photographic equipment and are increasingly used in day to day life. Necrosis of mucosa in contact with a button battery is well documented.[1-3] Little is known about the damage caused to skin and bone in contact with a button battery. Button batteries lodged in the external auditory meatus cause varying degrees of skin, bone and tympanic membrane necrosis. Button batteries lodged in the ear canal provide an otological emergency. We report three such cases.

Case reports

Case 1

A two and half year old boy was seen as an emergency referral with a 24 hour history of a foreign body in the right ear of uncertain nature. Otoscopy revealed a button battery in the deep external auditory meatus with proximal meatal oedema and erythema. Under general anaesthesia a corroded button battery (Berec B-SR44H) was removed revealing a small ragged central tympanic membrane perforation with gross peripheral myringitis.

The meatus was irrigated with sterile water and kept dry. Three months post operatively the perforation had healed and a free field audiogram was normal.

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Case 2

A 10 year old boy was seen as an emergency referral with a 12-hour history of severe right sided otalgia. He admitted inserting a button battery into the right ear 3 weeks previously. Otoscopy revealed black otorrhoea with gross meatal oedema. Under general anaesthesia a small corroded button battery (see Figure 1) was removed from the external auditory meatus to reveal eroded deep meatal skin

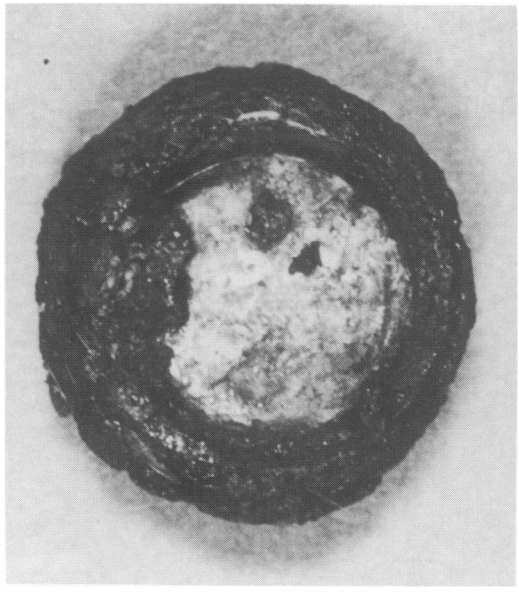

Figure 1 Corroded button battery with leaked electrolyte solution.

and bone, with multiple tympanic membrane perforations. Three months post operatively the right aural canal and pure tone audiometry were normal but a small central tympanic membrane perforation remained.

Case 3

A 79 year old demented woman presented with a 3-day history of right otalgia and a 2-day history of a black sanguinous otorrhoea. Otoscopy revealed the presence of a foreign body lodged deeply within the external auditory meatus with proximal meatal oedema. A corroded zinc alkaline button battery (Duracell 675 cell) was removed under general anaesthesia to reveal necrotic deep meatal skin with underlying bony erosion. The tympanic membrane had a large ragged posterior perforation. Eight days post operatively the patient died from an unrelated cause.

Discussion

The three case reports highlight the tissue destruction caused by a button battery lodging in the external auditory meatus. Each patient was right handed and had placed the battery in their right ear. Button batteries contain a metal anode, generally zinc, and a metal oxide cathode, usually mercury oxide or silver oxide, immersed in a strong alkaline solution, commonly 45% potassium hydroxide. Button batteries cause a cumulative electrical burn by low voltage direct current passing between the anode and cathode via the tissues of the external auditory meatus. The current passage is potentiated by the high conductivity of cerumen.[4] Exudation of tissue fluids caused by a burn injury creates a moist environment. *In vitro* studies have shown that spontaneous leakage of electrolyte solution occurs when alkaline batteries are exposed to moisture.[5] The leaked alkaline electrolyte solution has the ability to penetrate deeply into tissues producing a liquefying necrosis. This results in dissolution of protein and collagen, saponification of lipids, dehydration of tissue cells and consequential extensive tissue damage.[6] In our three cases the tissues involved were the tympanic membrane and the skin and bone of the external auditory meatus. Delay in the removal of a button battery, however, could potentially lead to ossicular erosion, facial nerve injury and necrosis of the medial wall of the middle ear resulting in a sensori-neural deafness and damage to the vestibular labyrinth.

We recommend that a button battery lodged in the external auditory meatus should be removed as a matter of urgency.

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